ELASTICITY OF DEMAND

Concept of Elasticity of Demand

"The elasticity of demand measures the responsiveness of the quantity demanded of a good, to change in its price, price of other goods and changes in consumer's income" - ***Dooley***

a) When change in quantity demanded is measured with respect to change in price of the commodity, it is called **Price Elasticity of Demand**.
b) When change in quantity demanded is measured with respect to change in income of the buyers, it is called **Income Elasticity of Demand**.
c) When change in quantity demanded of one commodity is measured with respect to change in the price of the commodity, it is called **Cross Elasticity of Demand**.

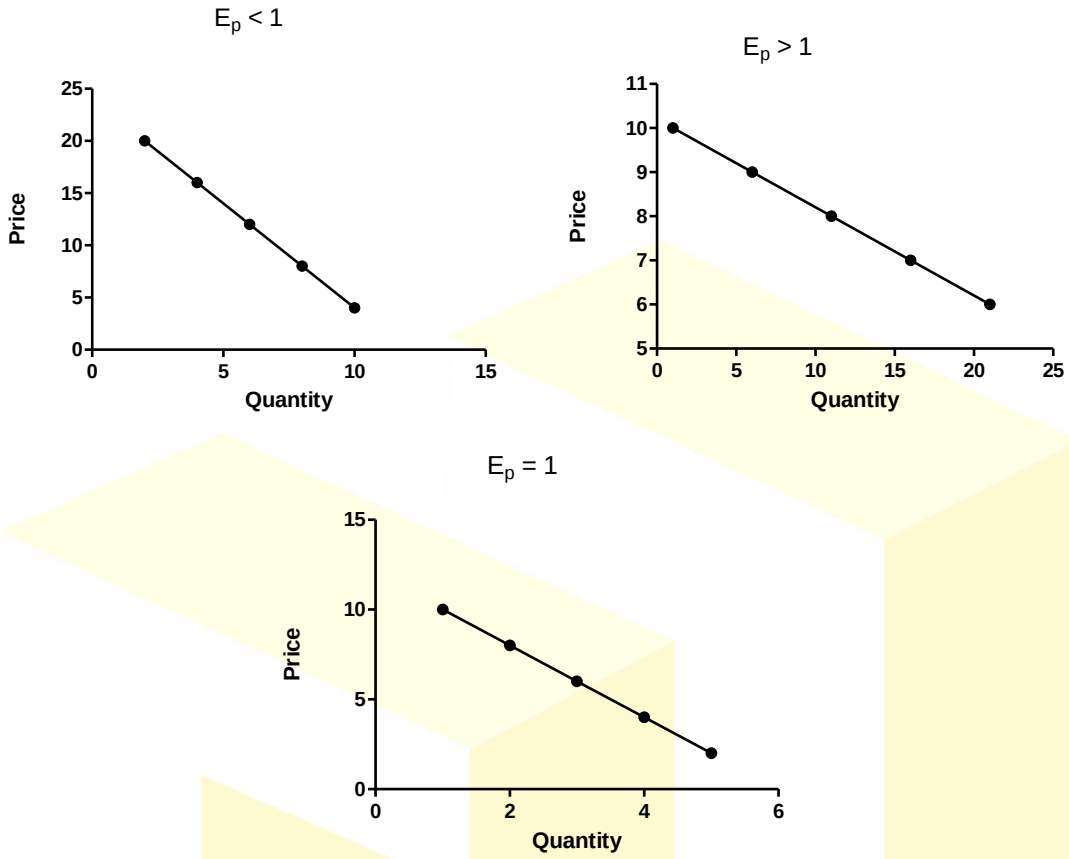
Price Elasticity of Demand

Price elasticity of demand indicates the degree of responsiveness of quantity demanded of a good to the change in its price, other factors such as consumer's income, prices of related commodities that determine demand, are held constant.

Price elasticity of demand is defined as the ratio of the percentage change in quantity demanded of a commodity to a given percentage change in price.

$$E_P = \%\text{ change in Quantity demanded} / \%\text{ change in Price}$$

Elastic Demand	$E_P > 1$	% Δ in Q > % Δ in P
Inelastic Demand	$E_P < 1$	% Δ in Q < % Δ in P
Unitary Elastic Demand	$E_P = 1$	% Δ in Q = % Δ in P

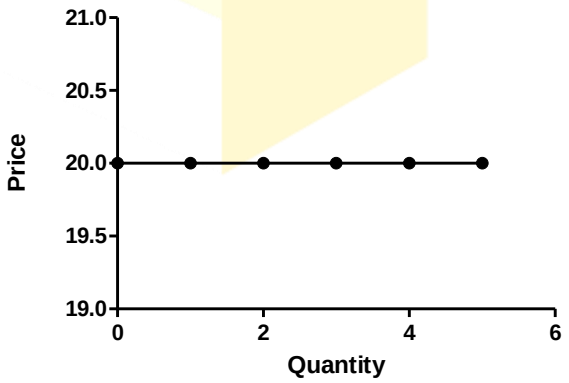


Unitary Elasticity of Demand at all points of Demand Curve- A special case

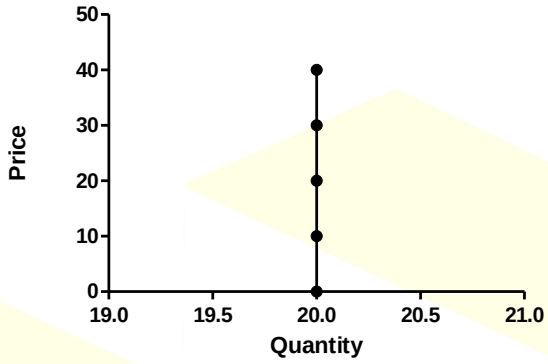
Rectangular hyperbola is a curve under which all rectangular areas are equal. This implies that total expenditure is equal. Hence it can be concluded that elasticity of demand=1 at all points of rectangular hyperbola.

Perfectly Inelastic and Perfectly Elastic Demand

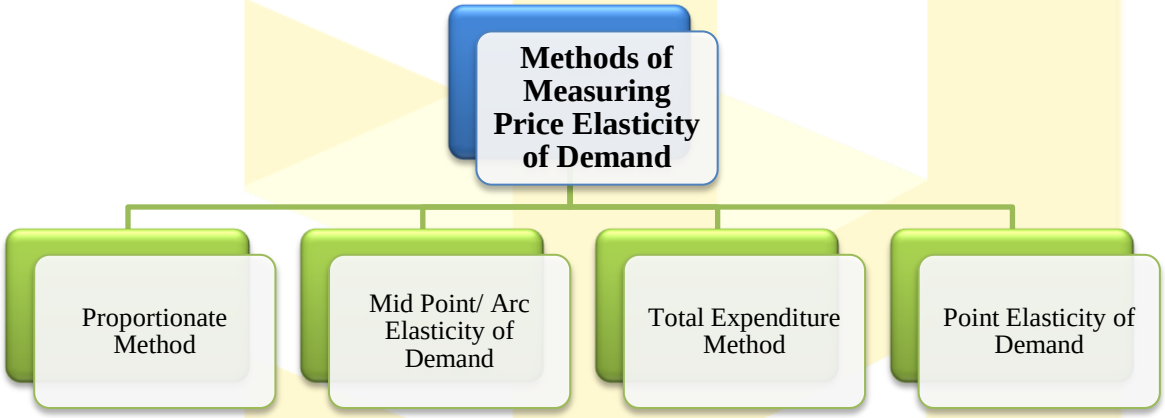
Perfectly Elastic Demand- Demand is **infinite** at the prevailing price. A slightest rise in price causes the quantity demanded of the commodity to fall to zero.



Perfectly Inelastic Demand- A change in price causes no change in the quantity demanded. It is a situation where even substantial changes in price leave the demand unaffected.



Measurement of Price Elasticity of Demand



1. **Proportionate Method**: It was suggested by Marshall

$$E_P = (-)\frac{\text{Proportionate change in Quantity demanded}}{\text{Proportionate change in Price}}$$

$$= (-)\frac{Q_2 - Q_1}{Q_1} \Big/ \frac{P_2 - P_1}{P_1}$$

$$= (-)\frac{\Delta Q}{Q_1} \Big/ \frac{\Delta P}{P_1}$$

$$= (-)\frac{\Delta Q}{\Delta P} \cdot \frac{Q_1}{P_1}$$

2. **Mid Point Method/ Arc Elasticity of Demand**: This method is usually used when there is a large change in price.

$$E_P = \frac{(Q2 - Q1)}{(P2 - P1)} * \frac{(P1+P2)}{(Q1 + Q2)}$$

Simplifying it,

$$E_P = \frac{\Delta Q}{\Delta P} * \frac{(P1+P2)}{(Q1 + Q2)}$$

Note: Finding Price Elasticity from a Demand Function

Q = a-bP

Where: Q = Quantity Demanded

P = Price

B = Slope (ΔQ / ΔP)

E_P = (ΔQ / ΔP) * (P/Q)

= **b * (P/Q)**

3. **Total Expenditure Method**: Evolved by **Marshall**

Situation	Δ in Price	Δ in Qty	Δ in Expenditure	Elasticity of demand
A	↓	↑	Constant	Ed = 1 (Unitary elastic)
B	↓	↑	Increases	Ed>1 (Greater than unity)
C	↓	↑	Decreases	Ed < 1 (Less than unity)

4. **Point Elasticity of Demand**: It can be measured using the ratio of lower segment to upper segment.

$$E_d = \frac{\text{Lower segment}}{\text{Upper segment}}$$

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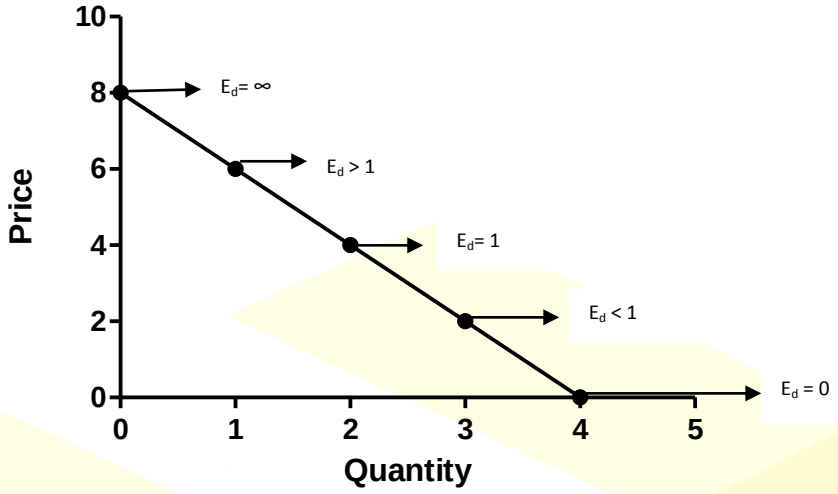

Determinants of Price Elasticity of Demand

1. **Availability of Substitutes**:

Availability of Substitutes	Elasticity
(1) Yes	Relatively more elastic
(2) No	Inelastic demand

2. **Proportion of Consumer's Income spent**:

Proportion of Consumer's Income	Elasticity
Large	Relatively more Elastic
Small	Relatively less Elastic

3. **Number of Uses of a Commodity**:

Number of Uses of a Commodity	Elasticity
Greater number of uses	Relatively more elastic
Less number of uses	Relatively less elastic

4. **Complementarity between goods**: Households are generally less sensitive to the changes in the prices of goods that are complementary with each other or which are jointly used as compared to those goods which have independent demand or are used alone.

5. **Time Elasticity**:

Time Involved	Elasticity	Reasons
Long Period	Elastic Demand	Consumers can substitute goods in the long run.
Short Period	Inelastic Demand	Substitution of one commodity for the other is not easy.

Cross Elasticity of Demand

Cross Elasticity of Demand measures the degree of responsiveness of change in the demand for one good in response to the change in price of another good.

$$E_c = \frac{\text{Proportionate change in the quantity demanded of X}}{\text{Proportionate change in the price of good Y}}$$

$$E_c = \frac{\Delta Qx}{\Delta Py} * \frac{Py}{Qx}$$

Q_x = Quantity Demanded of Good X

P_y = Price of Good Y

Goods	Elasticity
Substitutes	Positive
Complements	Negative

Importance of Cross Elasticity of Demand for Business Decision Making

1. Helps in formulating proper price strategy.
2. Helps in defining the boundaries of an industry and in measuring inter-relationships between industries.
3. It is used in U.S. in deciding cases relating to Anti-trust laws and monopolistic practices used by firms.

Income Elasticity of Demand

Income elasticity of demand may be defined as the ratio of the proportionate change in the quantity purchased of a good to the proportionate change in income which induces the former.

$$E_y = \frac{\text{Proportionate change in quantity demanded of a good}}{\text{Proportionate change in income}}$$

Type of Good	Elasticity
Normal good	$E_y > 0$
Inferior good	$E_Y < 0$

Type of Good	Elasticity
Luxuries	$E_y > 1$
Necessities	$E_Y < 1$

Sum of Income Elasticities, Budget Constraint and Expenditure

$$P_x . Q_x + P_y . Q_y = M \quad \text{...(1)}$$

P_x = Price of X

P_y = Price of Y

Q_x = Quantity purchased of X

Q_y = Quantity purchased of Y

Incorporating change in Equation (1);

$$P_X . \Delta Q_x + P_y . \Delta Q_y = \Delta M \quad \text{...(2)}$$

Dividing Equation (2) by ΔM;

$$\frac{PX . \Delta Qx}{\Delta M} + \frac{Py . \Delta Qy}{\Delta M} = \frac{\Delta M}{\Delta M} = 1 \quad \text{...(3)}$$

Dividing and Multiplying Equation (3) by M;

$$\frac{PX . \Delta Qx . M}{\Delta M . M} + \frac{Py . \Delta Qy . M}{\Delta M . M} = 1$$

This implies

$$\frac{PX . \Delta Qx . M . Qx}{\Delta M . M . Qx} + \frac{Py . \Delta Qy . M . Qy}{\Delta M . M . Qy} = 1$$

Rearranging the terms;

$$\frac{Px . Qx}{M} * \frac{\Delta Qx . M}{\Delta M . Qx} + \frac{Py . Qy}{M} * \frac{\Delta Qy . M}{\Delta M . Qy} = 1$$

$$K_x . E_{xi} + K_y . E_{yi} = 1$$

K_x = Proportion of income spent on X ($\frac{Px . Qx}{M}$)

K_y = Proportion of income spent on Y ($\frac{Py . Qy}{M}$)

Importance of Income elasticity for Business firms

1. Firms producing products which have a high income elasticity have greater potential for growth in an expanding economy.
2. Firms with low income elasticity for their products would not be much interested in forecasting future business activity.
3. Helps in designing marketing strategies of the firms.

Price Elasticity, Total Revenue and Marginal Revenue

"The revenue of a firm is its sales receipts or money receipts from the sale of a product." – ***Dooley***

By selling a commodity, whatever money a firm receives is called its **revenue**.

Total Revenue is the sum of money receipts of a producer corresponding to a given level of output.

$$TR = Price\ (P) * Quantity\ (Q)$$

Marginal Revenue is the change n Total Revenue on account of the sale if one more (or one less) unit of output.

$$MR = \Delta TR/\Delta Q$$

OR

$$MR = TR_n - TR_{n-1}$$

$$MR = \frac{d(TR)}{dQ}$$

$$= \frac{d(P.Q)}{dQ}$$

$$= \frac{P.dQ}{dQ} + \frac{Q.dP}{dQ}$$

$$= P\left[1 + \frac{Q}{P}.\frac{dP}{dQ}\right]$$

$$MR = P\left[1 + \frac{1}{ep}\right]$$

As elasticity is negative, therefore the formula becomes

$$MR = P\left[1 - \frac{1}{ep}\right]$$

Total Revenue (TR)	Marginal Revenue (MR)	Elasticity
TR maximum	MR = 0	$E_P = 1$
TR falling	MR is Negative	$E_p < 1$
TR rising	MR is positive (but falling)	$E_P > 1$